

## Session 2B: Toxic Contaminants in the Puget Sound/ Georgia Basin

### Questions & Answers

**Michael Salazar**

**Q:** I appreciate seeing your presentation for its second time since the Cherry Point technical workgroup, and I just have to reiterate some comments that I made to you at that time just to help explain some of the results. I understand you're just trying to describe what you observed and are not trying to implicate any source directly, but it seems to be important to note that when presenting such data, that a circulation model is obviously a critical thing to look at exposure for the various sites along there, just because the outfall at Arco would be appear low, mostly because the Fraser River is blowing most of that stuff south in the estuarine circulation of the sound, and it's important to look at the circulation model. And there is a model currently being developed, but it's not surprising to see the northern sites lower than the southern sites but also important to note in the annual variation that Arco was shut down for about half the year because of the pipeline being down, and they retooled the facility so the actual output from the places are not consistent over time. So it would really be helpful when describing these results, if we could make some characterization as to what we know about the inputs into the system—and there were distinct changes, it wasn't constant. And I think that helps to better characterize the results that you see.

**Salazar:** I'll tell you the same thing I told you at the meeting just so everyone can get that clear. We had a certain job to do and we did our job. The point he's making is absolutely correct and this needs to be put on the appropriate context, and we agree that DNR and other agencies should get together and share their information and include the different models and the different dispersion etc, I only use the word "surprising" for Arco; you would normally associate the pier with it. But you obviously need to take these other factors into account, and we're hoping that's the direction that these things will go.

**Q:** During the last two speakers, I didn't see any standard deviation or error bars. What percent of the mean are the standard errors?

**Salazar:** For the 2000 study we didn't have replication of a lot of stations so we couldn't put error bars on. For Brownsville, we did replication and the error bars were very small. There is very good consistency across stations. At Cherry Point, over the three years, the error bars again were very small. The data were incredibly close between years across stations, there was very little variability, but we took them off the slides and they are on the report and they will appear there. Where we can put error bars, they will appear.

**Sandie O'Neill**

**Q:** Did you do congeners?

**O'Neill:** This is an HPLC screen that's done by National Marine Fisheries Service, so there are about 15 different congeners that we looked at but they also give us a measure to total PCBs and that's what I am reporting here.

**A:** I actually did the statistical analysis but didn't put them on the chart. I did median concentrations of PCBs rather than average concentrations because they are not normally distributed and if you look at the lipid corrected concentrations of PCBs in these herring, statistically the Port Orchard fish have higher levels of PCBs than the northern Puget Sound stocks.

**Jim West**

**Q:** I'm a law professor. Can somebody say something about the sources of PCBs? You make it sound like an El Niño event, meaning it's basically totally beyond responsibility, and I realize the PCBs were ubiquitous pollutants. But frankly you put me out of business unless we have some indicator of sources and responsible parties. That is a question.

**A:** One of the things we can do, which we obviously didn't do for this talk, is sort of overlay our exposure data with sediment concentrations, and there's a fairly good correlation and the talk on Tuesday night. I'll present a slide that shows that very thing—the relationship between PCBs and the sediments and PCBs in fish so we can fairly confidently make that link. We can show a footprint in the sediments, but it's up to you folks to argue who put it there I think. But for these demersal or benthic species, it's becoming fairly clear—and this is common sense—that they are getting PCBs from where they live. And we are fairly certain it's from the prey they consume. The more local a fish is, and the more resident it is in an urban area, the greater probability you'll have.

**Q: I don't know how easy it is to capture rockfish, but I wonder if there's any evidence of either early sexual maturity or feminization, if they are getting PCBs deposited in the egg and they are getting it from their food? Would that be a signal, or has anybody looked at that?**

**A:** As far as I know, no one has looked at it. It is certainly in the suite of questions we have. Yes, absolutely. One of the easiest ways for us to obtain larvae is to sample the pregnant females. There may be some techniques that will allow us to look at sex ratios of larvae. But I'm not up on that, and this is all sort of on a shoestring, and we're sort of taking little steps towards that.

**Q: Could you tell me whether anyone is addressing effects of metals such as in the surface microlayer on herring or rockfish eggs or larval stages?**

**A:** Not from the surface microlayer. No one will pay anyone to work on it. Brent Moore from the Ministry of Environment Lands and Parks in Canada is going to talk about this in the session on spills. I don't know if he is addressing metals. I know it's PAH-related. We do look at metals accumulation in the fish and certainly from rockfish, and we can sort of do the summary. Mercury is also a fairly important contaminant toxic to rockfish in terms of exposure. In terms of the effects, I don't know. We don't have an effects threshold or range of thresholds that we have for some of the organics. Also from mercury, fish age seems to be one of the main drivers that older fish accumulate higher levels of mercury. There can be a sediment affect, a location affect, but it's usually dampened totally by the age affect of the fish.

**Q: Do herring or rockfish eggs ever interface with the surface of the Puget Sound?**

**A:** Herring eggs are spawned in the intertidal area on substrate. And because some of them can be truly intertidal, they can get to where the water on certain tides can fall below them, which would sort of lay down that surface microlayer and potentially coat them with the bathtub ring thing. Rockfish are live bearers that could risk free swimming larvae and, as far as I know, they are sort of surface oriented, but that sort of means in the top 50 meters, so not microlayer surface.

**Q: I wanted to just mention something that occurred to me back east when I was at a symposium there, and they were talking about the presence of vitellogenin in male large-mouth bass in a river system and I think it became an emotional issue because people thought, "Oh my God, vitellogenin. What's it doing in male serum?" But there's some work that has been done. I don't think it's been published yet, but behavioralists have shown sex reversal in a number of fish populations and certainly, if that's occurring in a population, vitellogenin would be a prominent signal, and it may not be an estrogenic compound that's causing it but maybe a stress-related situation.**

**A:** The literature on rockfish is fairly robust and extensive and as far as I know, they have been well-studied in the reproductive biology, and far as I know, there's been no evidence of sex changing. It's not a normal thing for them. I don't know about the response to stress, whether that can induce sex change. Also, for the rockfish that we sampled, we did have histological samples of some of the gonads and there was no morphological changes in the gonad to suggest sex change. They were definitely male or female.

**Q: I'm wondering about apparent lowering of levels of the contaminant at the time when there is an apparent estrogenic affect, and I'm wondering if in fact it could be possible for contaminant to be changed in format so it disappears from your screen? You are saying that the contaminant may**

**mirror activity of estrogen, and you are also saying that contaminant in females, the level of it, levels out when they start giving birth. The suggestion is that they pass it all along to their larvae. Is that, in fact, understood to be the case or could it be possible that some of it is converted through being an estrogenic mimicker to some other compound so that it also disappears?**

**A:** I don't think so. You remember your lock and key model from organic chemistry. Essentially, the congener molecule locks into the substrate and it just stays there, and it either prevents estrogen in a female from occupying that site or in males, it believes it's estrogen, so it doesn't actually change the molecule.